THE UNIVERSITY OF NORTH CAROLINA RECORD

JANUARY, 1916

NUMBER 133

THIRD ROAD INSTITUTE

FACULTY COMMITTEE ON EXTENSION

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RALEIGH
1916

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THE BUREAU OF EXTENSION,
Chapel Hill, N. C.

ANNOUNCEMENT

THIRD ROAD INSTITUTE

The University of North Carolina

1916

UNIVERSITY CAMPUS

CONFEDERATE MONUMENT IN FOREGROUND AND ALUMNI BUILDING TO LEFT

STATE OF NORTH CAROLINA

THIRD ROAD INSTITUTE

Held at the University of North Carolina, Chapel Hill, N. C.

February 7-12, 1916

BY

THE UNIVERSITY OF NORTH CAROLINA

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W. S. FALLIS, State Highway Engineer,
Raleigh, N. C.

NORTH CAROLINA GEOLOGICAL AND ECONOMIC SURVEY

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HUGH MACRAE .....Wilmington, N. C.
HENRY E. FRIES .....Winston-Salem, N. C.
F. R. HEWITT .....Asheville, N. C.
JOHN SPRUNT HILL .....Durham, N. C.
JOSEPH HYDE PRATT, State Geologist.....Chapel Hill, N. C.

OFFICERS OF INSTRUCTION

E. K. Graham, President of the University of North Carolina.

M. H. Stacy, Dean of the College of Liberal Arts and Professor of Civil Engineering.

Joseph Hyde Pratt, State Geologist and Director of the Road Institute.

W. S. Fallis, State Highway Engineer.

Collier Cobb, Professor of Geology, Uuniversity of North Carolina.

T. F. Hickerson, Associate Professor of Highway Engineering, University of North Carolina, and member of State Highway Commission.

Robert L. James, Highway Engineer and Associate Professor of Drawing, University of North Carolina.

John E. Smith, Instructor in Geology, University of North Carolina.

A. D. Williams, Chairman, State Road Bureau and Chief Road Engineer of West Virginia.

D. H. Winslow, Senior Highway Engineer in Charge of Field Maintenance of the U. S. Office of Public Roads and Rural Engineering, Washington, D. C.

R. E. Snowden, Highway Engineer of the North Carolina State Highway Commission.

D. Tucker Brown, Highway Engineer in Charge of Concrete and Bituminous Road Work in Guilford County.

W. A. McGirt, Chairman, Board of County Commissioners, New Hanover County.

R. A. Burnett, Road Superintendent of New Hanover County.

R. T. Brown, Highway Engineer in Charge of Road Construction of Davidson County.

J. B. Clingman, Highway Engineer of Madison County.

J. N. Ambler, Consulting Highway Engineer.

R. P. Coble, Highway Engineer of State Highway Commission.

H. B. Varner, President of State Penitentiary Board.

H. Hocutt, Highway Superintendent on Hickory Nut Gap Road.

James Mulligan, Superintendent of Construction of Roads in Davidson County.

JOHN CARRICKHOFF, Foreman of Road Work, Davidson County.

J. R. PENNELL, Road Engineer in Charge of Work in Greene County.

R. G. LASSITER, Road Contractor.

HON. JOHN H. SMALL, Congressman from the First North Carolina District.

R. B. WHITE, Franklinton, N. C.

SAM D. SCOTT, Highway Engineer of Wayne County.

IRA B. MULLIS, Highway Engineer of State Highway Commission.

NELLO L. TEER, Grading Contractor.

F. R. BROWN, Highway Engineer of Person County.

N. C. HUGHES, JR., Road Engineer and Superintendent of Halifax County.

CLOYD MILLER, Road Superintendent in Charge of Construction of Roads in Lovelady Township, Caldwell County.

JOHN D. WALDROP, Civil Engineer, Greensboro, N. C.

Representatives from the following companies are expected to be in attendance and give practical instruction in the use of various road machines, certain surfacing materials, and culverts:

The Good Roads Machinery Company, Kennett Square, Pa. Mr. RICHARDSON, Representative.

E. F. CRAVEN, Greensboro, N. C.

The General Utilities Company, Norfolk, Va.

Wyoming Shovel Company. C. H. BROWARD, Agent, Atlanta.

Smith & Sons Manufacturing Co., Kansas City, Mo.

Austin Bros., Atlanta, Ga.

The Barber Asphalt Paving Company, Philadelphia, Pa.

The International Harvester Company of America, Chicago, Ill.

The Thew Automatic Shovel Company, Lorain, Ohio.

Keystone Driller Company, Beaver Falls, Pa.

The Robeson Process Company, Pennington, N. J.

The Pomona Terra-Cotta Company, Pomona, N. C.

Southern Metal Culvert Association. G. P. GAVIN, President.

The Atlas Portland Cement Company, New York City.

Universal Portland Cement Company.

GENERAL ANNOUNCEMENT

It was realized for some time by those in close touch with the road work of the State that this work was not being conducted in an efficient or economical way, and therefore not to the best interests of the counties and communities. It was felt that those interested in the actual construction of the roads of the counties—whether they were engineers, superintendents, foremen, or supervisors—should be brought together at some general meeting to discuss the many problems which they had met in connection with their road work and to receive general instruction in regard to the best methods to be employed in road work, so that the large amount of money appropriated for this work would be more wisely and judiciously expended and the enormous waste of road funds, to a certain extent, checked.

The University of North Carolina became interested in this problem and joined with the North Carolina Geological and Economic Survey in holding a Road Institute at the University, March 17-19, 1914. The success and value of this first Institute to those attending was expressed in the following resolution passed just before the close of this Institute:

I. *Resolved*, That we express our thanks and appreciation to the Departments of Civil and Highway Engineering of the University and the North Carolina Geological and Economic Survey for the benefits which we have derived from the Good Roads Institute.

II. *Resolved, further*, That it is our belief that such an institute is of very great value to the good roads work of North Carolina, and it is also our belief and desire that the Institute be made an annual occurrence, and we herewith respectfully request the President of the University and the Director of the North Carolina Geological and Economic Survey that they seriously consider the holding of an annual Good Roads Institute at the University.

The request expressed in the resolution was considered very seriously by the President of the University and the Director of

the North Carolina Geological and Economic Survey, and it was finally decided to make it an annual Institute.

The North Carolina State Highway Commission, which was created by the General Assembly of 1915, also became interested in the work of the Institute and very willingly offered to coöperate with the other two State institutions in holding this, the Third Road Institute, and, therefore, the Institute is now under the joint supervision of the State University, the State Highway Commission, and the State Geological and Economic Survey.

It has really become the State School of Instruction for county road officials and a clearing-house for the road problems of North Carolina. It is, therefore, of very great value for all who are connected in any way with road work throughout the State.

North Carolina is constantly increasing her road revenue, and for the year 1916 there will be approximately $5,000,000 spent in some way in connection with road work in the State. A large proportion of this has been raised by bond issues.

It is beginning to be realized more and more, that in order to obtain the best results from the expenditure of these funds the very best business management and engineering skill possible must be employed; therefore, engineers, contractors, manufacturers, highway commissioners, and county road officials have been invited to attend this Institute to discuss ways and means, exchange ideas, and give suggestions in regard to various road problems which will be taken up for discussion. The inefficiency of any highway official or engineer affects the interest of the people of a community and also has a decidedly adverse effect upon the general movement for better roads. For this reason, all road engineers, superintendents, foremen, contractors, and commissioners should avail themselves of the opportunity to attend the Road Institute, not only for the benefits that they themselves may receive directly, but also for the good that they can confer upon others by giving their experiences in solving various road problems which they have had come under their direct experience or observation.

One of the great problems which confronts North Carolina today is the lack of trained men to handle the highway work and give it the careful consideration which its importance demands. There are many engineers within the State who have achieved

success in special lines of engineering, but who have not had any experience in the location or construction of roads, and, therefore, they cannot be classified as highway engineers; and if employed as such, it is impossible for them to do justice, either to their employers or to themselves. In some instances, engineers who have succeeded in other lines of engineering have attempted highway work with the result that the work was not either efficiently or economically done; and this proved the more conclusively that such work should have been left to the experienced engineer. For some time it has been considered that road construction did not require the services of a trained man; and in some instances men who have had little or no knowledge of engineering have made attempts to construct roads which have proved very costly to the community, not only in their first cost, but as a continuous expense, on account of the high maintenance charges, due to improper location, alignment, and drainage. Such mistakes have often been the reason why a county or community would discontinue the construction of better roads, and has often prevented adjoining communities or counties from beginning road work as soon as they otherwise would have done.

A skilled engineer can very readily acquire the knowledge and experience necessary to qualify him as a highway engineer, but it is not fair for a community to have to pay him for acquiring such knowledge and experience at the public's expense.

A road institute, such as is offered to the people of North Carolina, does not expect to be able to turn out experienced and efficient road engineers, but it does profess to be able to give information and instruction which will be of value and benefit to road engineers and increase the knowledge and efficiency of road superintendents, foremen, supervisors, overseers, etc. To the commissioners the Institute offers an opportunity of familiarizing themselves with the character of the road problems which must be considered, with the prospect of its bringing to them a clearer realization of the need of employing practical and experienced men to have charge of the road work in the county over which they, as commissioners, have jurisdiction. There is no question but that by bringing together the engineer, the superintendent, the foreman, and supervisors, that they can, through an interchange of views and experiences,

greatly benefit each other; and it is the aim of the Institute to make the lectures as practical and instructive as possible, so that those attending will be in a position to give better service to their counties and communities.

The practical demonstrations that will be given in regard to maintenance or upkeep of highways, the use of various road machines, etc., will undoubtedly result in more practical and economical work being done throughout the State. The value of this work is such that it is believed any county commission will be fully justified in detailing their road superintendent, foreman, and supervisors or overseers to attend the Institute and appropriate enough money from the county funds to pay their expenses.

The staff of instruction includes not only men of the University, but men of experience and high reputation from other States and from various counties of North Carolina. The work will be taken up systematically and sufficient time allowed for a thorough discussion of each subject, and all those in attendance are invited and urged to take part in the discussions, either by asking questions or answering them. There will be exhibits of road machinery, road materials, road models, maps, charts, etc., and there will be outdoor instruction given in methods of maintenance of roads and the use of certain road machines.

There are no fees for attending the Institute and no text-books are required. Certain books and pamphlets will be distributed, however, to those attending, which will give information of value regarding subjects discussed. The Institute is designed to meet the needs of the road builders of North Carolina and is open to any one who wishes to attend.

Those who desire to attend are urged to notify the Director as soon as possible, so that accommodations can be provided. Board and room may be secured in the village, at the hotel or boarding-houses at from $1 to $2 per day. Arrangements can be made for a certain number of rooms in the college buildings, and rooms can be obtained in several of the houses in the village. Those rooming in this way can obtain their meals at Swain Hall at 15 cents each. On account of the number who expect to attend the Institute, more satisfactory arrangements can be made for the comfort of the members if they will notify the Director, Joseph Hyde

Pratt, Chapel Hill, that they will attend and apply for reservation.

How to Reach Chapel Hill

Chapel Hill is on a branch line of the Southern Railway, extending from University on the Greensboro-Goldsboro Division. Trains leaving Greensboro at 9:20 a. m. and 4:05 p. m make close connection at University for Chapel Hill. From the east there is a wait of from three-quarters of an hour to one and a half hours at University.

Automobiles from Chapel Hill meet all trains at Durham, and it will be found that a quicker trip can be made to Chapel Hill for those coming from the east by changing at Durham and coming over on the automobile. The 7:30 a. m. train from Greensboro reaches Durham at 9:28 a. m., and connection can be made by automobile to Chapel Hill. The automobile fare is 75 cents one way, or $1.25 for the round trip. These are special rates for members of the Institute.

PEABODY HALL
(NEAR CAMERON AVENUE ENTRANCE TO CAMPUS)

PROGRAM

MONDAY, FEBRUARY 7, 1916

PEABODY HALL

9:00 a.m.—1:30 p.m. Enrollment and Assignment of Rooms.

2:30 p.m. Address of Welcome.....PRESIDENT GRAHAM
2:50 p.m. Address .....DEAN STACY
3:15 p.m. The Work of the Institute.....DIRECTOR PRATT
3:30 p.m. The State Highway Commission and Its Relation to County Work .....MR. FALLIS
4:30 p.m. Recess.

7:30 p.m. Social Hour. Peabody Hall.

TUESDAY, FEBRUARY 8

PEABODY HALL

MAINTENANCE AND REPAIR OF ROADS

9:00 a.m. Introduction ..... MR. PRATT

9:15 a.m. Patrol System of National Highway..... MR. WINSLOW

10:15 a.m. Maintenance of New Hanover County Roads .. MR. MCGIRT
Discussion—MR. BURNETT.

11:00 a.m. The Road Drag..... MR. SNOWDEN

11:30 a.m. The Road Hone ..... MR. WINSLOW and MR. RICHARDSON

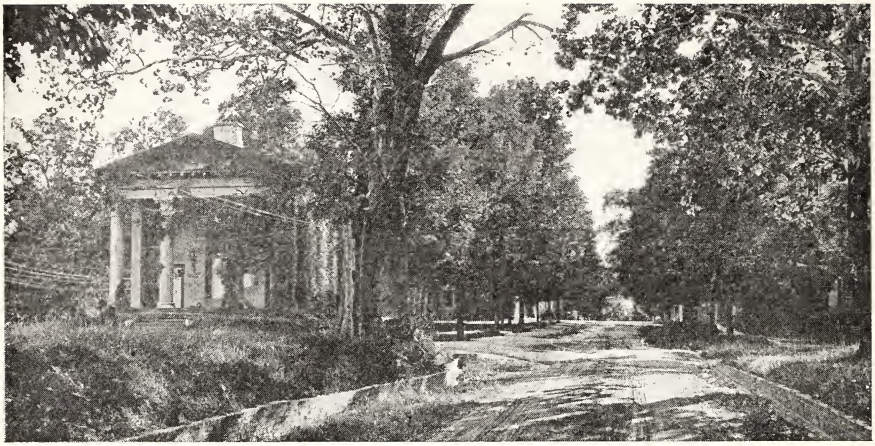
12:00 m. County Road Organization and Financing..... MR. WHITE

2:30 p.m. Demonstration of the Construction and Use of the Road Drag (in front of Peabody Hall).
MR. R. T. BROWN and MR. CLINGMAN

4:00 p.m. Practical Instruction in Maintenance..... MR. WINSLOW

5:00 p.m. Recess.

7:30 p.m. Good Roads in Other Lands (Illustrated Lecture). MR. COBB



CAMERON AVENUE, LOOKING WEST

WEDNESDAY, FEBRUARY 9

PEABODY HALL

ROAD CONSTRUCTION

9:00 a.m. Location of Roads.....MR. WILLIAMS

9:50 a.m. Needed Preliminary Survey and Investigation for County Road Work .....MR. COBLE

10:15 a.m. Steam Shovels .....REPRESENTATIVE OF COMPANY
Discussion by MR. HUGHES and MR. FALLIS.

10:40 a.m. Use of Steam Shovel in Madison County Road Work.
MR. CLINGMAN

11:00 a.m. Relation of Superintendents and Engineers to Highway Commission .....MR. WILLIAMS

11:30 a.m. Relation of Contractors to Commissioners and Engineers .....MR. LASSITER

12:00 m. Road Machinery .....MR. WINSLOW and MR. TEER
REPRESENTATIVES OF VARIOUS COMPANIES

12:30 p.m. Recess.

2:30 p.m. County Road Work and Its Relation to State Work.
MR. WILLIAMS

3:15 p.m. Demonstration of Use of Road Machinery on Raleigh Road:

Road Plow .....MR. MULLIGAN and MR. CARRICKHOFF

Road Machines .....MR. WINSLOW and MR. TEER

(In the demonstration of this machinery, a section of the Raleigh road to the east of the campus will be ditched, crowned and brought into shape, ready either for surfacing or for maintaining as a dirt road.)

7:30 p.m. Maintenance of Roads (Illustrated).....MR. WINSLOW

THURSDAY, FEBRUARY 10

PEABODY HALL

MAINTENANCE AND REPAIR OF ROADS

9:00 a.m. Instructions to Patrolmen.....MR. WINSLOW

10:00 a.m. Economic Use of Prisoners in Repair and Maintenance of Roads .....MR. HOCUTT

10:30 a.m. Use of State's Prisoners in Road Construction..MR. VARNER

11:00 a.m. Essential Qualifications for a Highway Engineer.
MR. AMBLER
Discussion: MR. HICKERSON and MR. STACY.

11:45 a.m. Geology as an Asset to a Highway Engineer.....MR. COBB

12:30 p.m. Recess.

2:30 p.m. Instruction in Maintenance.....MR. WINSLOW

3:30 p.m. Practical Demonstrations in Maintenance and Use of Various Road Implements.
MR. WINSLOW, MR. FALLIS, MR. MULLIGAN and MR. R. T. BROWN, Demonstrators, and REPRESENTATIVES OF VARIOUS COMPANIES.

7:30 p.m. Address .....CONGRESSMAN SMALL
Gerrard Hall.

THE LIBRARY

FRIDAY, FEBRUARY 11

Peabody Hall

ROAD SURFACING MATERIALS

9:00 a.m. The Selection of Surfacing Materials for Highway Construction ..... Mr. Pratt

9:30 a.m. Sand-Clay and Topsoil ..... Mr. Coble
Discussion: Mr. Smith.

9:50 a.m. Report on the "Topsoil" Road Between Chapel Hill and Durham ..... Mr. Hickerson

10:10 a.m. Limit of Endurance of Sand-Clay and Topsoil Roads. Mr. Winslow
Discussion: Mr. Hughes and Mr. Pennell.

10:45 a.m. Gravel Roads ..... Mr. Coble

11:15 a.m. Macadam Roads ..... Mr. Fallis

11:30 a.m. Bituminous Macadam ..... Mr. D. Tucker Brown

11:45 a.m. Concrete ..... Mr. Fallis

12:00 m. Guilford County Concrete and Bituminous Roads. Mr. D. Tucker Brown

12:15 p.m. Bituminous Materials ..... MR. JAMES

12:30 p.m. Brick ..... MR. PRATT

12:45 p.m. Recess.

2:30 p.m. Caldwell County's $1,000 Roads..... MR. MILLER

3:00 p.m. Field Demonstrations:

Use of Abney Hand Level..... MR. HICKERSON

Testing Sand-Clay Mixtures.. MR. MULLIS and MR. SMITH

Mixing Sand and Clay..... MR. COBLE

Spreading Gravel ..... MR. COBLE

7:30 p.m. Round Table: Reports from County Superintendents and Engineers.

SATURDAY, FEBRUARY 12

Peabody Hall

CULVERTS AND BRIDGES

9:00 a.m. Area of Waterway.....Mr. Hickerson

CULVERTS

10:00 a.m. Use of Various Types of Culverts.....Mr. Pratt

10:30 a.m. Terra-Cotta Culverts.

Representative of Pomona Terra Cotta Company

Corrugated Iron Culverts .....Mr. Gavin

Concrete Culverts .....Mr. R. T. Brown

Rubble Masonry .....Mr. Fallis

BRIDGES

11:00 a.m. Steel I-Beam Bridges .....Mr. R. T. Brown

Steel Truss Bridges .....Mr. Fallis

Concrete Bridges.

Wooden Bridges .....Mr. Hickerson

12:30 p.m. Adjournment.

NORTH CAROLINA ROAD STATISTICS FOR 1914

ROAD MILEAGE

Total mileage of public roads	51,811
Total mileage of macadam roads	1,119
Total mileage of sand-clay roads	4,717
Total mileage of gravel roads	640
Total mileage of special surfaced roads	56
Total mileage of roads graded but not surfaced	4,103
Total mileage of unimproved dirt roads	41,176

ROAD FUNDS

BOND ISSUES

The total amount of bonds issued by counties and townships in North Carolina to January 1, 1915	$ 8,770,800
Amount voted during 1914	1,059,500
Amount of bonds sold during 1914	2,459,000
Estimated amount of bonds voted during 1913 and 1914, to be used during 1915	1,500,000
Bonds voted since January 1, 1915, which were probably used during 1915	1,175,000

SPECIAL TAX

Amount of special tax raised for road purposes in counties and townships during 1914	$ 1,972,402
Amount of special tax used for interest and sinking fund on bond issues	600,000
Portion of special tax money used in road construction and maintenance	1,372,402
Portion of above amount used for construction (est.)	500,000
Portion used for maintenance or repair purposes (est.)	872,402

FREE LABOR

Estimated value of labor tax, rating each day's labor at one dollar, used for road repair	$ 617,065

CONVICT LABOR

Approximate number of short-term convicts used by counties and townships	1,800
Number of State convicts used in public road work (aver.)	140

MONEY SPENT IN CONNECTION WITH ROADS DURING 1914

Special tax (including $125,000 private subscription)	$ 1,972,402
Bond issues	2,430,000
Value of convict labor (1,800)	360,000
Value of free labor	617,065
Total	$ 5,379,467

BENEFICIAL RESULTS OF IMPROVED ROADS

1. One of the chief beneficial results from good roads is that the farmer, fruit grower, trucker, and others will be able to economize time and force in the transportation of products between country and market. The distance a farmer lives from market is not a question of miles, but of the roads he must travel over to reach that point. How many hours and how many horses does it require to haul a load to market? When thus measured, ten miles of good, smooth highway are not as long as a few miles of mud and stone.

Let me illustrate this further. Two men were discussing the respective merits of their farms. One said, "I am only three miles from the market, while you are five." "Yes," said the other, "but my five miles is over a hard graded road, over which my two horses can easily haul two tons, while your road is hilly and rough, and you would not think of putting more than three-fourths of a ton on your wagon." Farmers are realizing more and more that the distance they live from market is measured in time and not in miles.

2. Another advantage that improved roads will give to a community is that farmers will be able to take advantage of market fluctuations in buying and selling, and to take advantage of any demand that may arise for any of their products. An up-country town needed fruits and vegetables to supply its market, which was bare, and such stuff was selling at a high price. Farmers living within only a few miles of this town had apples, potatoes, cabbage, etc., which were spoiling on their hands, and they were greatly in need of all the money they could get for these products. And yet, it was just about as hard for the farmers to carry their goods to market over the boggy clay hills as it would have been if there had been a very wide river with nothing but a little birch-bark canoe to cross in. Who suffers in this case? The consumer suffers just as badly as the farmer. Both have to pay the penalty for the bad roads. This is not the only instance in which both lose; it is so nearly every year.

A few years ago a cotton grower held his cotton for a predicted advance in price. He was justified in doing this, as cotton went

to twelve cents, but the cotton grower was unable to take advantage of this good price as he was unable to haul his cotton to market on account of the muddy condition of the roads, and he was not over five miles from town. What he lost would have been sufficient to have paid not only his road tax, but all his taxes for many years.

3. A third important beneficial result from good roads, and one that is not often considered, is the ability to haul products to and from market at any time during the year. Many a farmer has had to do his hauling to and from town during good weather when he and his teams were badly needed on the farm, because, during the rainy weather, the roads were in such bad condition that it was impracticable for him to attempt to do any hauling. Yet the rainy days and those immediately following were the days that he should have been able to haul, for he could not work his crop. This practical result of good roads would mean to many farmers a great deal more per year than any road tax they would have to pay to obtain good roads in their county.

4. Improved roads have a very important bearing in connection with obtaining better rural schools. Improved roads make it possible to substitute for a little schoolhouse of one room and one teacher a consolidated or graded school with half a dozen rooms and half a dozen teachers. The schoolhouse of one room and one teacher was good, but the graded school of half a dozen rooms and half a dozen teachers is vastly superior, and we want to secure that for the children in all our counties.

It doesn't cost as much to build a schoolhouse of half a dozen rooms as it does to build six schoolhouses of one room each. Six teachers working together can do vastly better work for the children than one single teacher who has to teach children of all ages, from the cradle to the voting age. Instead of having twenty to thirty children of different ages in one school, so that the community spirit is an impossibility among them because of the diversity of age and of the difference in attainments, hundreds of children can gather into this graded school, where class spirit and community spirit will thrive and good teaching abound.

Another important part that good roads will play in connection with improved school facilities and extension of rural graded

schools is that the district can be enlarged and the pupils carried to and from school in free busses provided by the school district. Then, instead of having one- or two-room schoolhouses scattered every few miles through a district, the people can have a large graded school, to which the children can be carried a distance of two to five miles. This is a practical scheme which is being operated successfully in many of the middle Western and Northern States, and has been started in Virginia with splendid results.

The schoolhouse is becoming the social and intellectual center of the community, and now, in their construction, arrangements are made for an assembly room that can be used by the people of the community for various social gatherings and community meetings.

5. Rural free delivery will be extended as good roads are constructed, and it is practically dependent upon good roads, for with the construction of good roads there will be an increase in population and of the earning capacity of the adjacent farms, which will mean a greater amount of mail matter to be delivered. This is emphasized in a report of the Postmaster General, who said: "The requirement precedent to the establishment of rural delivery is to be a possible patronage of 100 families on a standard route of 24 miles; that the road be kept in good condition, unobstructed by gates, and with all streams fordable at all seasons of the year." Many routes have been threatened with discontinuance if the roads over which the rural mail carrier had to travel were not put in better condition. But few who have had the benefit of rural mail delivery want to see the routes given up, and those who do not have rural delivery want it. It must be remembered, however, that the routes will follow good roads.

6. Tourists, capitalists, investors, and others visiting any section of North Carolina will be much more favorably impressed with the financial possibilities of any manufacturing enterprise, or the commercial value of any farm or timberland, by driving to them over good roads. If these same places have to be visited over poor roads they will lose more than half of their value in the sight of the prospective investor, as his thoughts have been so entirely taken up with the bad road over which he has been compelled to travel.

The Southern Appalachian region has been most fortunately and richly supplied with those natural attractions that are demanded by tourists; but we lack the one great necessity that will make these natural attractions available to the tourist, namely, "good roads."

The Southern Appalachian mountain region should be attracting hundreds of times as many tourists as it is doing at present. The tourists want to come and drive and motor through this section, but we have failed to give them the good roads that make this possible.

Coaching and automobiling for pleasure is not a fad of short duration; it is a form of pleasure that will be in vogue for generations and generations. Such pleasure trips, however, will not be taken over poor roads, but parties will select those sections of the country that are traversed by good roads. When we have our system of good roads throughout North Carolina we should be able to attract tens of thousands of tourists into the State that are now going to the White Mountains of New Hampshire, the Berkshires of Massachusetts, the Adirondacks of New York, and to Switzerland, Northern Italy, and France.

7. The State of North Carolina is at the present time extremely interested in the subject of immigration, and through its several departments is making considerable effort to bring certain classes of European and American immigrants into the State.

It is not the desire of the State to simply obtain an influx of labor, but to obtain an influx of homeseekers who will become citizens of the State and at the same time furnish the kind of labor that is needed. We desire the better class of homeseekers, and these will want and demand school facilities for their children and good roads to connect them with town and railroad. The class of European immigrants that are desired in North Carolina have been accustomed to excellent roads in their own country, and it is natural that a section of country that is traversed by good roads connecting the various farming districts with markets and provide easy means of intercourse between different neighborhoods will be more attractive than those districts in which the roads are poor and, at some times of the year, almost impassable.

We not only want European immigrants, we want to attract

Americans from other sections of the United States to North Carolina to invest in our farm lands, our waterpowers, and to build up manufacturing industries. Good roads are of vital importance to these classes of men. There is no doubt but hundreds and even thousands of good farms in North Carolina remain wholly or partially uncultivated and unproductive on account of the very poor condition of the roads connecting them with town and market.

The counties that are attracting the most capital and labor are those in which the roads are in the best condition. These counties will continue to derive the most benefit from any movements that are made for bringing capital and labor into North Carolina. Good county roads indicate a prosperous county, and it will be found that the richer, more progressive and more liberal counties are those which have spent a great deal of money in building good and permanent public roads.

Every class seeking new homes and new investments will select their locations on good roads. Some will be deterred from investing on account of the poor roads in the sections where they had expected to settle. Many do not want to settle in our cities, towns, or even villages, but want to be out on farms five or ten miles from the city or town, but want to be connected with the city by good roads. If good roads are so important to those coming into North Carolina, whether they be capitalist, health, pleasure, or homeseekers, or laborers, how much more important should good roads be to those already settled here.

8. Another and very important effect of improved roads on a rural community is the decided improvement in its social conditions. The social condition of the community is dependent upon the facility with which the people can gather together for some common purpose, and the ease with which intercourse can be had between neighbor and neighbor, country and town. In a community that is traversed by good roads it is possible for the people to have social intercourse with each other and to attend school, church, and public entertainments at any time during the year without it being necessary to drive or walk through the mud. Bad roads are a decided hindrance to social intercourse, and at some times during the year travel may be completely suspended.

"The esthetic value of roads well built and clean is sometimes reluctantly conceded or even denied by individuals. It is noticeable, however, that along improved roads there is a visible tendency for farmers to improve the appearance of their homes and their outbuildings. In fact, the presence of good roads seems, many times, to stimulate latent self-respect into practical expression. There is no wonder that a bog of well-nigh impassable mud before one's door should react unfavorably upon the entire family. The improved road not only has an esthetic value in itself, but it is potent in awakening the dwellers along its borders to a sense of esthetic values in farm buildings and home surroundings."

At the present time it is possible for any country place to have all the modern conveniences that can be found in any city home and at no more expense than these same comforts cost in the city, yet if the country home is supplied with all these, but is separated by five to ten miles from the city by bad roads, these other modern improvements count for but little.

Undoubtedly, one of the strongest factors toward keeping the young people on the farm will be the improvement of the public roads. It is the isolation of rural homes, due to bad roads, that our young people are objecting to and not the work or the life on the farm itself.

JOSEPH HYDE PRATT.

REPAIR AND MAINTENANCE OF HIGHWAYS

The need of effectual repair and maintenance of highways has now become well recognized. The resulting demand for better methods and more certain results is insistent.

During the last two decades there has beeen a remarkable development of highway building which is intimately associated with State aid and State control, especially in the region north of the Ohio and east of the Mississippi River. The evolution of present-day conditions in the above States is particularly important in its bearing on highway repair and maintenance.

The rapidly increasing automobile traffic on highways has measurably stimulated interest in road improvement and profoundly modified methods of construction and maintenance.

There is need for much improvement in road management. Where good business organization has been applied to the work of repair and maintenance, it has always responded with better results. Since it is commonly held that future advance in road betterment is largely dependent upon successful management, corresponding emphasis is here given to that subject.

It is now recognized that there is a sharp distinction between the terms *repair* and *maintenance,* as applied to operations upon highways. When a road of any type is completed, the effects of travel and the elements tend to destroy it. Those operations required constantly to oppose the deterioration of the road constitute general *maintenance.* Without maintenance, the road after a time is partly destroyed, and operations then necessary to restore is constitute *repair.* It is true that both processes are often similar in kind and may overlap. They differ in quantity and in the order in which they are applied. A road properly maintained may not need repair for an indefinite interval, but a road properly repaired always needs maintenance. The term "strict maintenance" may be used to denote those operations that continuously keep a road true to its type, whether or not such operations restore the constant wear of the traveled way. When the hard surface of a road becomes worn so thin that resurfacing is necessary, such operation must at present be classed as *repair,* even though resurfacing operations may at times involve practically a reconstruc-

tion of the road surface. If a macadam road were paved with brick or rebuilt of concrete or other material and the result were decreased annual maintenance, such work would be essentially reconstruction. To indicate the kind of maintenance which constantly replaces a worn surface and so preserves the integrity of the road, the term "absolute maintenance" seems justified, and is being used.

REPAIR OF EARTH ROADS

At the beginning of the year 1913, 90 per cent, or approximately 2,000,000 miles, of the roads in this country were earth. The repair and proper maintenance of earth roads are therefore of great importance.

The repair of an earth road has for its object the development of a crowned traveled way, dry and firm under travel, and of proper width. It is desirable that this traveled way be reasonably straight and not too steep. It is known that it is first necessary to protect the roadway from water, and, therefore, repair operations begin with drainage. Pure sand roads are an exception to this principle.

Drainage intercepts water which would otherwise reach the road and removes water which accumulates on the road. A broad shallow ditch on each side of the traveled way is required for drainage. Such ditches must have ample outlets into natural drainage channels, and all culverts to carry water across the road should be kept free from obstructions. When the road soil is clay, the side ditches should be deepened and the traveled way somewhat raised to increase the protection against water. It is clear that with a reasonably firm smooth surface, water cannot remain on the traveled way.

"Thank-you ma'ams" should not be constructed across the road. Outlets for gutters are needed at every low point and should be large enough to carry off the *worst* flood water quickly. To do this, outlets need to be built with a large factor of safety. In deep cuts and on hillside roads it is frequently necessary to dig a bank ditch above the road on the shoulder of the slope in order to intercept surface water from the hillside. Such ditches should discharge water into natural channels entirely away from the road. When culverts of any kind cross the roadway, they must be kept

in repair, particularly at the ends, and there must be no doubt about their being clear. Particular attention is needed at driveways into abutting property or at road intersections to prevent obstructions to drainage. Small pipes with shallow covering leading under driveways nearly always break and clog with refuse. In many places it will pay in the end to regrade the entrance and pave the gutter, leaving an open passage for water. Even when suitable pipes are in place and well covered, if the driveway or intersecting road is poorly crowned, the surface flood water from adjacent land is carried directly on the road. This is prevented where paved gutters are used at entrances.

MAINTENANCE OF EARTH ROADS.

To preserve a properly built or repaired earth road, it has been repeatedly demonstrated that the best method is some system of continuous maintenance. Continuous maintenance prevents the necessity of extensive repairs and keeps the road always in good condition. The operations involved in maintenance are in one sense small repairs. The economy in small repairs over extensive periodic repairs is largely due to the fact that defects in a road develop at an *increasing* rate if allowed to continue, and the cost of restoring the road to the normal condition is consequently made greater than the actual sum of the costs of repeated minute repairs. The advantage to the traveling public in continuous maintenance is self-evident.

The split-log drag, or some of its modifications, has proved beyond doubt the best tool for earth-road maintenance. This drag may be made with either two split halves of logs from 6 to 8 feet long and 6 to 8 inches thick, shod with iron, or with planks from 3 to 4 inches thick, shod with iron, or sometimes by splitting a railroad tie with a saw. It is drawn by two horses, and is designed to run at an angle to the axis of the road. The object of the drag is to move a small quantity of earth and also to puddle the surface.

The road drag is designed to reduce ruts by paring action and to smooth and harden the surface of a traveled way, and it does both. The action of the drag involves the movement of a *small* quantity of earth combined with a puddling action. It is not intended to grade a road as a road grader does. When the drag cuts

too deeply, the hitch may be shortened. When it slides excessively with a long hitch, weight may be added temporarily to insure some cutting. The best time to use the drag is after a rain, as the surface of a road is then soft enough to be cut easily and is in the best condition to puddle. By its capacity to move small amounts of earth toward the center, the road drag maintains the correct crown, which always tends to flatten. By its capacity to puddle the surface, the drag builds up successive thin layers of material, which gradually become waterproof and harden while drying. Dragging should begin at the outside of the road and progress toward the center. The road drag is not a cure-all for bad roads, although almost any road is helped by dragging. To secure the best results the road should be in good repair as to section and drainage, and the drag should be used often, especially in the first season. An old road full of cobbles used to fill "chuck" holes cannot respond to dragging. The drag should be used always when the road is wet but not so sticky that mud clings to the blades. This is often the case in the black soils of the Middle West, and a smoothing drag or slicker is used successfully in such conditions. Dragging a dry road is of no benefit. The road drag, consequently, is peculiarly adapted to a system of continuous road maintenance, and the annual cost is low.

The essential factor in earth-road maintenance by dragging is to have a definite mileage of road in charge of a responsible man who owns a team of horses and lives on or near the road. Dragging can seldom be arranged to occupy the whole time of a team, and some form of unit price is therefore required. As a rule, when a general system of road dragging is established in a community, a healthy spirit of rivalry develops among the men in charge of separate sections and good results follow. Frequently, in rural sections, the dragging is done when the team would otherwise be idle.

The patrol system has prevailed in the past largely on macadam roads. In France, up to within a few years, it was universal, and the French roads were the best maintained roads in the world. The system allots a definite section of road to the care of a man who puts all his time on the work, and he is expected to supply hand tools and a horse and cart. An objection has been raised to

the patrol system on earth roads because of the expense. The wages of the patrolman employed continuously eight months of the year may result in apparently excessive mileage costs. The excellent results of continuous patrol work are, however, so certain that a patrol system combining dragging should be tried before dismissing the plan. There is more or less continuous hand work involved in all earth road maintenance. Such work includes clearing side ditches of all obstructions, reducing water-breaks, repairing wash damage during and immediately after storms, keeping culverts and driveway drains free at all points, placing new material on the traveled way, removing loose stones, and caring for the right-of-way. Such work prevents expensive repairs. The care of the right-of-way includes clearing brush and cutting dead and other objectionable trees, removing weeds, trimming gutter lines, etc. Leaves on a road are a constant menace to drainage and produce a poor surface condition when wet and ground into the soil. It is perfectly clear that after a time work on the right-of-way and drainage may be reduced to a small fraction of the original amount, and still there is a residue of necessary constant hard work. It always pays to have a man on earth roads part of the time, and strict maintenance cannot otherwise be realized. A good system of maintenance should include a traffic census taken systematically and thoroughly, especially on roads which indicate the need of some form of hardened surface.—*U. S. Office of Public Roads.*